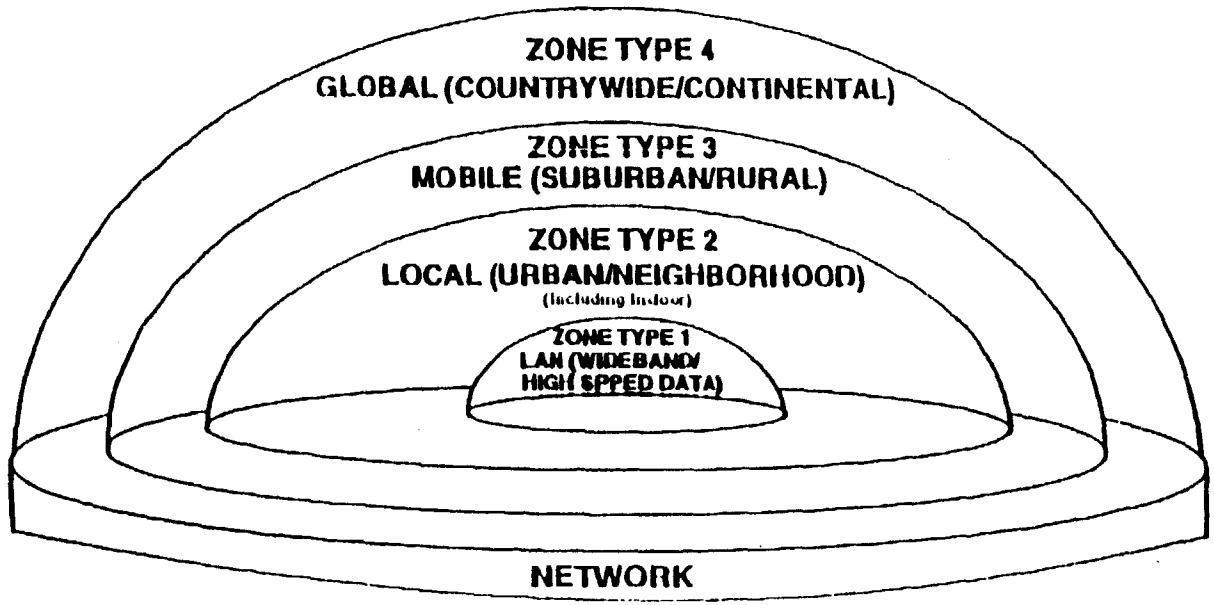
ZONAL SERVICES MODEL

Grouping of Application Environments



ATTRIBUTES:

- GENERAL COVERAGE VIA MULTIPLE ZONES
- EACH ZONE TYPE HAS ASSOCIATED AREA OF COVERAGE
- USER SERVICE ENVIRONMENT DEPENDENT ON ZONE TYPE
  - SERVICE TYPE
  - GRADE OF SERVICE
  - TRAFFIC DENSITY
- PERMIT PROVISIONING OF MULTI-ZONAL SERVICES FOR END USERS
- MODEL SUPPORTS IMPROVEMENTS AS TECHNOLOGY EVOLVES:
  - EXPANSION IN SCOPE OF SERVICES
  - IMPROVEMENT OF TRANSPORT RANGE
  - UPGRADING OF SERVICE QUALITY

Figure 3.3.2

- Zone 1-

Aspects of Zone 1: Licensed/non-licensed, low to high speed data rates, wideband data, no hand-off, little mobility, small cell.

Application environment:

Indoor Office / Home

Wireless LAN (Primarily an indoor service. Can be indoor/outdoor)

Short haul video (e.g.: VCR extenders)

- Zone 2 -

Aspects of Zone 2: Low speed, small cells, low to medium speed data rates, licensed/non-licensed.

Application environment:

Outdoor:

Outdoor Pedestrian (e.g., Telepoint, PBX campus environment)

Outdoor fixed (e.g., wireless local loop)

Indoor:

Indoor Commercial (e.g., public access service at mall/airport)

Indoor Residential (e.g., cordless)

Indoor Office (e.g., PBX, shared tenant)

Passenger Relays (e.g., bus, train, subway, cruise ship)

Specialized Aeronautical Passenger Communications(APC)[4]

- Zone 3 -

Aspects of Zone 3: High speed (e.g. accommodate vehicular speed handover), large cells, low to medium speed data rates, licensed. (Note: this does not preclude non-licensed use of this zone.)

Application environment:

Vehicular (e.g., cellular like)

[4] This was broken out because of a unique regulatory environment.

Rural (more power/wider cell)

Zone 4 -

Aspects of Zone 4 - Satellite based, high speed, regional to global coverage, low to high speed data rates, licensed.

Application environment:

LEO Satellite

GEO Satellite

Aeronautical Communication (air to ground, passenger to ground via on-board relay).

3.3.4.2 General Aspects of All Zones

The zonal model is a layered model for the grouping of the environments. See Figure 3.3.2 for the conceptual drawing[5].

"Indoors" implies location of base station is generally indoor although access may be available from outside.

Services are not limited to voice but can include voiceband data, video, imaging, and facsimile services.

Traffic density varies in each zone dependent on applications, technology, infrastructure and distribution of users.

3.3.5 Task 4: Comparison and Evaluation of Common Air Interfaces for PCS Applications

3.3.5.1 Recommendations

- The JTC will strive to compare technologies.
- An optimal system will operate well across multiple environments and zones.
- In Comparing Systems:
  - Systems should be able to be defined with a layered approach similar to the layered OSI model

[5] The original drawing is in contribution TR45.JEM/92.11.09.232 (T1P1/92-232)

- Systems should be based on existing standard protocols when ever possible.

- The JTC should have the flexibility to mix and match technologies and system parameters to define optimal system(s).

- The following is an example of how the JTC might compare Air Interfaces:

  - Systems should first be identified for the application environment(s) under which they will operate.

  - Comparison of systems should only be done between systems to operate under the same application environment(s).

  - Each operating environment should have a comparison matrix.

  - The minimum set of customer services and features generated by the JEM should be included in any performance comparison.

3.4 Related to Objective 4

Objective 4: Reach consensus on an industry-needs driven schedule for required air interface Standards.

3.4.1 Introduction

The ten (10) contributions received in Objective 4 were assembled into three distinct categories. The first category of contributions was furnished for information and gave the JEM a timeline for standards development from a user's prospective. The second grouping dealt with network architectures and provided a network model template which was ultimately adopted as the Common Reference Architecture Model.

The third grouping of contributions was primarily concerned with the methodology of comparing and evaluating one or multiple air interfaces and the time requirements for the development of those interfaces. In addition, information of a work plan was submitted by CCIR.

3.4.2 Issues and Discussions

- ***Develop and recommend a network reference model*** - Discussion took place regarding the Functional Network Reference Model Template. It was noted that this template represents a high-level view of the network reference model common talk points. There was consensus, and the template was accepted as the basis for the development of all network reference models. We should focus on the interfaces used in the reference models. The model was renamed the Common Reference Architecture/Model.

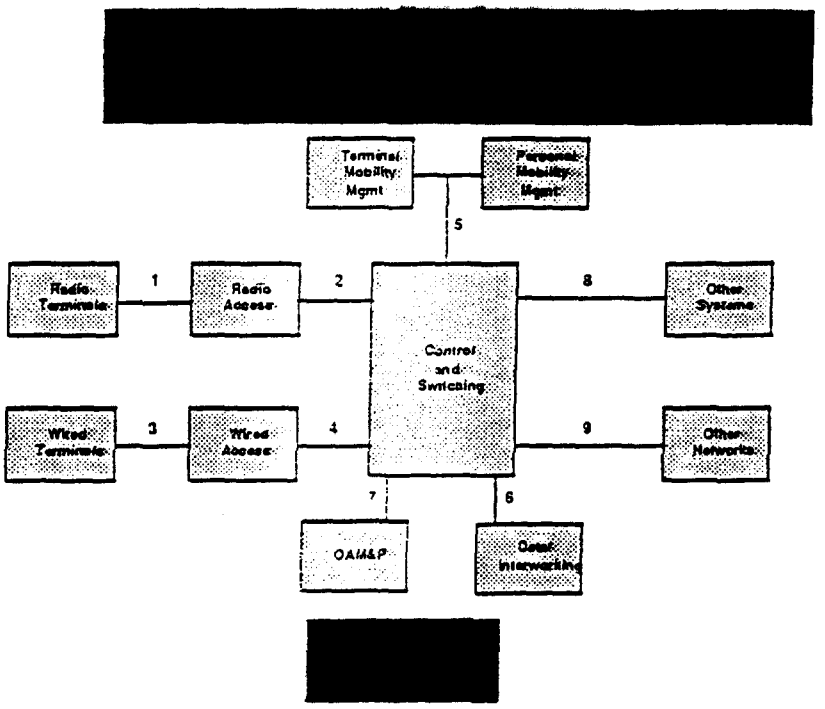


Figure 3.4.1 Functional Network Reference Model Template

- Common Reference Architecture Model (CRAM) identifies and defines general functionalities required to provide switched telecommunications services employing terminal and personal mobility to wired and wireless terminals, and provides access to OAM&P and data interworking capabilities as well as interconnection to other systems and networks.

  The CRAM may be used to facilitate further discussion between various groups developing reference architectures/models and interfaces which provide for personal communications. The CRAM functionalities are identified within contribution TR45.JEM/92.11.09.251 (T1P1/92-251).

  The CRAM does not preclude additional interfaces that have been identified by standards bodies, but are not shown in this high-level view.

- Identify and describe interfaces depicted in model - Questions were raised as to how the interfaces should be labeled. It was decided to refer to each interface by number and the associated functional blocks.

- "1" is the interface between *Radio Terminals* and *Radio Access*.
- "2" is the interface between *Radio Access* and *Control and Switching*[6].
- "3" is the interface between *Wired Terminal* and *Wired Access*.
- "4" is the interface between *Wired Access* and *Control and Switching*.
- "5" is the interface between *Control and Switching* and *Mobility Management*.
- "6" is the interface between *Control and Switching* and *Data/Interworking*.
- "7" is the interface between *Control and Switching* and *OAM & P*.
- "8" is the interface between *Control and Switching* and *Other Systems*.
- "9" is the interface between *Control and Switching* and *Other Networks*.

- **Identify and recommend specific standards to be developed -**

  It was noted that the group has to design the basic service first (wireless PLAIN OLD TELEPHONE SERVICE (POTS)). The concern was that the PCS Standard Development group may loose sight of the users needs and the service providers' objectives. This group must first focus on basic functionality. A list of the basic functionalities to be provided over all relevant interfaces include:

  1. Security - System/Air Interface
  2. Authentication
  3. Mobility - personal and terminal
  4. Origination/termination
  5. Roaming
  6. Handover
  7. Bearer services
  8. Performance requirements
  9. Registration
  10. Location

[6] This interface has been labeled A and A1 by CTIA; A and A1 by TR45; C, F, and P by T1P1 and C and P by Telocator in their architectural reference models - See TR45.JEM/92.11.09.251 (T1P1/92-251).

11. Power Management
12. Maintenance and Diagnostics
13. Call Data Recording
14. Adaptability
15. Backward/Forward Compatibility

- **Recommend the sequence of interface development -**

  Discussion continued on what interfaces should be addressed first. Discussion began with Interface 1. Discussion quickly moved onto Interface 2. Eventually discussion drifted onto the order in which these interfaces should be addressed. There was consensus that the standards groups should address Interfaces 1 and 2 immediately and in parallel because they may require the most effort. It may also be necessary to immediately address other interface standards mandated by the FCC.

- **Identify Interdependencies -**

  It was determined that all interfaces need to be addressed in parallel by the standards bodies.

  Coordination of development is required due to the commonality of basic functionality that needs to be provided across all these interfaces. PCS standards should be developed using a systems engineering approach.

- ***Estimate time to draft standards and compare with market needs time line -***

  In response to the JEM's objective to identify the "relative timing of PCS standards based on industry needs", Telocator presented the timeline diagram of Contribution TR45.JEM/92.11.09.230(T1P1/92-230). This timeline is based on estimates of the dates at which the FCC will accomplish the major milestones necessary to reach the awarding of PCS licenses. Based on the assumption of services starting in 1995, the analysis concluded that PCS standards need to be defined expeditiously in order to complete them by the end of 1993 (at least ready for balloting).

  In terms of the CRAM, this timeline implies that Interfaces 1 and 2 are of the highest priority. Although the other interfaces are not of the same priority as Interfaces 1 and 2, it is recognized that parallel efforts must occur on these interfaces to support the introduction of PCS.

  Also, it is recognized that, dependent on market needs, other interfaces may need to be defined, and that the CRAM does not preclude the definition of these interfaces.

  The JEM recognized that this was a reasonable analysis of the PCS industry situation as of the fall of 1992. However, it also recognized that the industry's regulatory environment is

dynamic and will probably continue to change. Thus the JEM accepted the timeline presented in Contribution TR45.JEM/92.11.09.230 (T1P1/92-230) as the current assessment of the industry needs, with the recommendation that the responsible standards bodies (including the JTC[7], in the case of air interface standards) be prepared to accept new inputs on the industry's needs as regulatory schedules change.

3.4.3 Recommendations

1. In order to develop a standardized air interface within a reasonable time frame, it is recommended that existing air interfaces as well as related interface standards be evaluated for their applicability to PCS.

2. If there are going to be multiple air interfaces, the methodology described in contribution TR45.JEM/92.11.09.235 (T1P1/92-235) might be used for evaluation of those interfaces.

3. Interface 1 should be standardized consistent with industry requirements. In addition, the other interfaces as defined by the CRAM, should be developed in parallel with interface 1 because they are interdependent.

4. It was noted that there may be a need to hold a JEM to discuss interfaces other than the air interface. As areas of duplication between various standards bodies are identified, additional JEMs or JTCs might be recommended.

5. Based on an analysis by Telocator, PCS standards need to be substantially completed by the end of 1993 (at least ready for balloting). Interfaces 1 and 2 were deemed to be highest priority, and were regarded as being needed by 4Q 1993. The JEM recognized that this was a reasonable analysis of the PCS industry situation as of the fall of 1992. However, it also recognized that the industry's regulatory environment is dynamic and will probably continue to change. Thus, the JEM accepted the timeline of contribution TR45.JEM/92.11.09.230 (T1P1/92-230) shown in Figure 3.4.2 as the current assessment of industry needs, with the recommendation that the responsible standards bodies (including the JTC, in the case of air interface standards) be prepared to accept new inputs on industry's needs as regulatory schedules change.

6. It was recommended that the following process is appropriate for development of air interfaces standards for PCS and may be used as the method of evaluation. This process is based on the idea of 'top-down' design, and placing priority on assuring that market-based service needs are addressed early in the development process.

[7] The current scope and charter of the JTC is to address the lower layers of the Air Interface

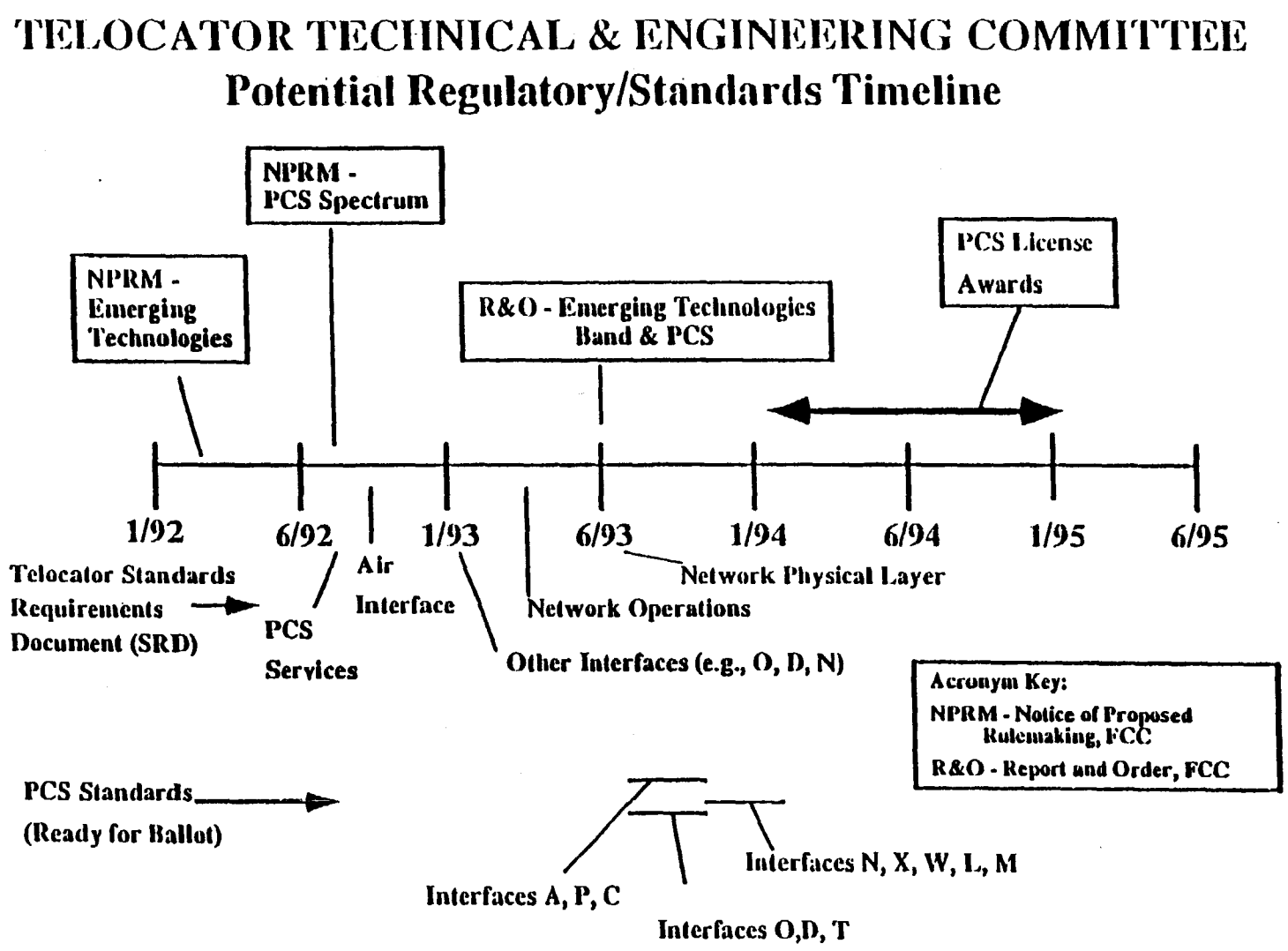


Figure 3.4.2 Standards Development Timeline

Process for Development of air interface standard

1. Definition of services for licensed and non-licensed bands.

The radio interface must be capable of supporting all the services requirements in various environments. An example of a set of service requirements can be found in "Standard Requirements Document" for Personal Communication Services prepared by the Telocator PCS Technical and Engineering Committee. In this phase of the process, system capabilities should also be addressed. Examples of system capabilities are security, billing integrity, mobility management, etc.

2. Operational issues

At this stage of the process operational issues need to be considered. Examples of operational issues that need to be addressed are:

- Spectrum: The impact of sharing etiquette(s) and spectrum requirements for various applications should be considered. The possible impact of spectrum sharing methodologies on the air interface should be included.

- Interworking: Interworking is the ability of a handset to access different networks that have a common air interface.

- Interoperability: Interoperability is the ability of a handset to operate in different networks with unlike air interfaces.

- Equipment approval: Consideration should be given to the possibility that parts of the air interface specification might be subject to authorization or approval of regulatory bodies.

3. Performance Requirements/Market Issues

The most basic performance requirements for future PCS air interface standards should be identified and used as ground rules for the development of the air interface standard. Technologies under consideration must meet these minimum performance requirements. Development of air interface standards should be prioritized according to market demands for initial products.

4. SUMMARY

This summary highlights the output from the discussions on the JEM objectives. The actual recommendations can be found at the end of the respective objective sections.

The JEM agreed that indoor residence, indoor office, indoor commercial, outdoor vehicular, outdoor pedestrian, and wireless loop environments could impact radio systems and air interface design. Some services and capabilities impact the design of the PCS air interface and its design should allow graceful evolution to support future services and capabilities.

The JEM produced a set of minimum service capabilities for voice and data services which, in many cases, can and should be exceeded.

The JEM recommends that the Air Interface be defined so as to enable the cost effective design of a terminal that could be used both in licensed and non-licensed bands. A comprehensive study of the applicability of a variety of proposed air interfaces to their respective operating environment should be completed.

The JEM agreed that it appears that a single air interface should be technically feasible for office (WPBX/CENTREX), home (including multi-tenant), fixed local loop and pedestrian (indoor/outdoor) environments. It was determined that the vehicular environment places additional requirements on the air interface.

A set of recommendations were generated in connection with spectrum sharing.

The JEM found that although it was desirable to have a single air interface, it was unlikely that a single air interface that met all requirements could be achieved. Multiple Air Interfaces are likely and expected. The remaining issue is selecting the minimum number of air interfaces.

The JEM recommended a method of comparing air interfaces that could be implemented in advance of the FCC rulemaking. It is the responsibility of the service providers to weigh the strengths and weakness of the proposed Air Interfaces in accordance to their view of their subscriber requirements and their business strategy. To actually perform the weighting and selection of an air interface requires a definite FCC rulemaking prior to implementation.

The JEM agreed on the need for substantially completed standards for PCS by the end of 1993. Particularly Interfaces 1 and 2 require high priority, and parallel development of the other interfaces are needed for completion by 4Q 1993. Methodologies were suggested for evaluation of multiple air interfaces and for the development of PCS air interfaces standards.

The JEM suggested evaluating existing air interfaces and related standards for applicability to PCS, and that identification of areas of duplication between different standards groups may require calling additional JEMs or JTCs.

The meeting was conducted in accordance with the TIA guidelines and T1 procedures.

Charles Cook, Co-Chair, JEM on PCS Air Interfaces Standards

Wing Lo, Co-Chair, JEM on PCS Air Interfaces Standards

5. CONTRIBUTIONS AND REFERENCE DOCUMENTS LIST

5.1 Contribution Documents List

NUMBER	COMPANY	TITLE
200		Agenda
201		Contribution Register
202	Withdrawn	Withdrawn
203	Withdrawn	Withdrawn
204	Interdigital	Spectrum Sharing Using Dynamic Capacity Allocation
205	Withdrawn	Withdrawn
206	Interdigital	PCS B-CDMA System Overview
207	Interdigital	CDMA Overlay/Underlay Cells Efficiency
208	Rockwell	Freq. Allocation Analysis #1
209	Rockwell	Freq. Allocation Analysis #2
210	Rockwell	Requirement for Wireless Standards
211	Rockwell	Semiconductor Advances
212	Rockwell	Air Interface Considerations
213	Rockwell	PCS Interworking
214	Rockwell	PCS and North American Cellular Glossary list of Acronyms
215	Withdrawn	Withdrawn
216	Withdrawn	Withdrawn
217	Bell Mobility	A Service Providers View on Multiple Air Interface
218	Ericsson	Wide Area Packet Data Service
219	Ericsson	DCS 1800 in Europe
220	Ameritech	Spectrum Allocation for PCS
221	Ameritech	RF Transmit Power for Licensed and Non-licensed Devices
222	Motorola	Proposed Method for Comparison and Evaluation of Air Interface for PCS Applications
223	Motorola	A Manufacturer's Viewpoint on the Possibility of Single Air Interface for Multiple PCS Applications
224	Telocator	Telocator Standards Requirements Documents (SRDs) on Aspects of Personal Communications Services
225	Telocator	Telocator Position Regarding PCS Spectrum Sharing/ Coordination Issues
226	Telocator	Technical Issues Related to PCS Sharing with Fixed Microwave Systems
227	Telocator	Advantages of Single and Multiple CAIs
228	Telocator	Analysis of Power Tradeoffs

229	Telocator	Non-Licensed Sharing Etiquette (Unlicensed Part 15)
230	Telocator	Telocator Position on Timeline for Standards Development
231	AT&T	An Expansive View of PCS
232	AT&T	A Zonal Services Model for Wireless Access Interfaces
233	AT&T	A CPE Non-licensed Application Profile for a Premises Air Interface
234	AT&T	A CPE Non-licensed Prospective on a Single Air Interface
235	AT&T	Functional Architecture Model for PCS Wireless Interface
236	T1P1.2	T1P1 Reference Architecture for Personal Communications
237	Motorola	Abstract of proposed TDMA/TDD Air Interface to meet the PCS requirements in the U.S.
238	Motorola	Abstract of proposed FDMA/TDD Common Air Interface to meet the PCS requirements in the U.S.
239	Motorola	PCS/Microwave Spectrum Sharing
240	US WEST	Emphasis of JEM Work on low-power Air Interface(s)
241	Motorola	The Motorola PPS-1800 Low Tier Wireless Personal Communication System
242	Motorola	Motorola PPS-1800 High -Tier Wireless Personal Communication System
243	SW Bell	Spectrum Sharing Methodology Requirements
244	SW Bell	IMASS - Compatible PCN Protocols
245	SW Bell	Applications and Services Requirements for PCS
246	SW Bell	Process for Development of PCS Air Interface Standards
247	SW Bell	Characteristics Required of an air interface standard for PCS
248	Motorola	Motorola PCS System Using DS-CDMA
249	PCN America	Interference Cancellation in Personal Communications
250	JEM Co-Chairs	Personal Communications Services Feature and Service Description List
251	TR45.4	Functional Network Reference Model Template
252	NTI	A Spectrum Management Methodology (SMM) for Spectrum Sharing
253	NTI	Cost Penalties of Multiple Air Interfaces
254	T1P1.3	T1P1 Service Description Work
255	CCIR TG8/1	CCIR Draft Opinion on National/Regional Support of FPLMTS Efforts
256	CCIR TG8/1	CCIR Task Group8/1 FPLMTS Work Program Information
257	CCIR TG8/1	Annex 1 "Characterization of Radio Interfaces" of CCIR Task Group 8/1 Draft Recommendation on Radio Interfaces for FPLMTS

258	CCIR TG8/1	CCIR Recommendation 816 ""Framework for Services Supported on FPLMTS"
259	CCIR TG8/1	CCIR Task Group 8/1 Liaison to CCITT Study Group 1 on FPLMTS Services
260	Telocator	Telocator Wireless Access Characterization Report
261	Telocator	Standards Requirements Document:Common Air Interface for PCS
262	Telocator	Telocator Spectrum Sharing Report: An Overview of Spectrum Sharing Technologies for the Emerging Technologies Band
263	Telocator	Spectrum Allocation for Personal Communication Services
264	Bell Mobility	The Unified Layers of Personal Communications
265	US West	Critical Tasks for Physical Layer Stands. Development for Wireless Access
266	T1P1.3	Technical Report for Low Power Wireless Access to Personal Communications Services System and Service Objectives

5.2 Reference Documents List

Telocator	PCS SRD
T1P1.1	Draft Technical Report - Program Management of Standards for Personal Communications
IEEE P802.11	Functional Requirements
FCC	NPRM (92-9)
FCC	"Report and Order , Third NPRM (92-9)"
FCC	"NPRM and Tentative Decision (90-314, 92-100)"
Telocator	Reference Network Architecture

6. ACKNOWLEDGEMENT

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A thank you to the Exective Planning Committee who gave so much of their time in planning the meeting. Exective committee members were:

Ed Ehrlich	Northern Telecom
Gary Jones	PCN America
Graham Haddock	Motorola
Howard Sherry	Bellcore
Larry Gitten	AT&T
Narses Colmenares	AT&T
Vino Vinodrai	Bell Mobility Cellular

A thank you to Cathy Haughton of Bell Mobility Cellular for helping to print and distribute the final report.

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Sharp	Prem Sood	1 206 834-8708/8696

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